

CLAIMS

What is claimed is:

1. An optical device for discretionary treatment of channels of an optical beam, said optical device comprising:
 - a port for at least transmitting or receiving a first beam having a plurality of channels;
 - a wavelength discriminating device optically coupled to said port, said wavelength discriminating device adapted for at least one of receiving said first beam and diffracting said beam into a plurality of channel beams or receiving a plurality of channel beams and combining said channel beams into said first beam; and
 - an array of reflective elements, said reflective elements exceeding the number of channels, at least a portion of said reflective elements being optically coupled to said wavelength discriminating device and reflecting said channel beams, at least two reflective elements of said portion corresponding to a particular channel beam, said at least two reflective elements being controllable to effect a desired output of said particular channel beam.
2. The optical device of claim 1, wherein said at least two reflective elements are controllable to perform at least one of coupling said particular channel beam to one or more ports, switching said particular channel beam among two or more ports, attenuating all or a portion of said particular channel beam, or creating a group delay profile in said particular channel beam.
3. The optical device of claim 1, wherein said optical device has x, y, and z axes with the z axis being along the optical axis of the port, and wherein said reflective

elements are controllable such that they are moveable in at least one of three directions, a first direction in which the reflective element is rotated about the y axis, a second direction in which the reflective element is rotated about an axis parallel to the x axis, and a third direction in which the reflective element is moved along the z axis.

4. The optical device of claim 3, wherein said reflective elements are configurable in just the first direction.

5. The optical device of claim 3, wherein said reflective elements are configurable in all three directions.

6. The optical device of claim 3, further comprising:
secondary ports, said port and secondary ports being aligned along the y axis with their optical axes parallel to the z axis, and wherein a certain movement of two or more adjacent reflective elements about an axis parallel to the x-axis causes a channel beam to couple with a port along said y-axis.

7. The optical device of claim 6, wherein said certain movement of said two or more adjacent mirrors about an axis parallel to the x-axis causes a channel beam to switch from one port to a different port along said y axis.

8. The optical device of claim 6, wherein said certain movement of said two or more adjacent mirrors about the y-axis produces a group delay profile in said channel beam.

9. The optical device of claim 1, wherein said array is a linear array.
10. The optical device of claim 1, wherein said array is a two dimensional array.
11. The optical device of claim 1, wherein each reflective element has a width of less than 50 μm .
12. The optical device of claim 1, wherein said array of mirrors has a linear fill density of no less than about 95%.
13. The optical device of claim 1, wherein the z delta of adjacent reflective elements of a common channel complies with the following equation:
$$\lambda/2 n - \lambda/8 \leq z \text{ delta} \leq \lambda/2 n + \lambda/8, \text{ where } n = 0, 1, 2, \dots 1000.$$
14. The optical device of claim 1, wherein said reflective elements are configured in at least one of three ways, a first way in which at least a portion of said reflective elements receive said channel beams from said wavelength discriminating device, a second way in which at least a portion of said reflective members reflect said channel beams to said wavelength discriminating device for combining into said first beam, and a third way in which a different portion of said reflective elements reflect a portion of said channel beams to said wavelength discriminating device for combining into a second beam having fewer channels than said first beam.
15. The optical device of claim 14, wherein said reflective elements are configured in said first and third way.
16. The optical device of claim 14, wherein said reflective element are configured in said first way only.

17. The optical device of claim 16, wherein said wavelength discriminating device is not in the optical path between said reflective elements and said secondary ports.

18. The optical device of claim 15, wherein said wavelength discriminating device is in the optical path between said reflective elements and said secondary ports.

19. The optical device of claim 14, wherein said reflective elements are configured in said second way only.

20. The optical device of claim 14, wherein said reflective elements are configured in said third way only.

21. The optical device of claim 1, wherein said port is a fiber.

22. The optical device of claim 1, further comprising:
secondary ports wherein each secondary port reflects a secondary beam having
an equal or fewer number of channels than said beam.

23. The optical device of claim 22, wherein at least one secondary beam is a single channel beam and wherein at least one secondary beam is a multichannel beam.

24. The optical device of claim 22, wherein said port is an input port and said secondary ports are output ports.

25. The optical device of claim 22, wherein said port is an output port and said secondary ports are import ports.

26. The optical device of claim 1, wherein said port is an input and an output port such that it transmits said beam and receives a secondary beam.

27. The optical device of claim 1, wherein said wavelength discriminating device comprises one or more of the following a diffraction grating, prism, and an arrayed waveguide grating (AWG).

28. A method of assembling an optical device having one or more ports, a wavelength discriminating device optically coupled to one or more ports, an array of reflective elements, wherein the number of reflective elements significantly exceeds the number of channels handled by said optical device, said method comprising:

disposing said array of reflective elements in said optical device such that a portion of the reflective elements is in the optical path of a channel beam optically coupled to said wavelength discriminating device, and adjusting the portion of the reflective elements to optically couple said channel beam with a desired port.

29. The method of claim 28, wherein the reflective elements are disposed in the optical device using passive alignment.

30. A method of configuring an optical device for discretionary treatment of channels of an optical beam, said optical device having one or more ports, a wavelength discriminating device optically coupled to one or more ports, an array of reflective elements optically coupled to said wavelength discriminating device, wherein the number of reflective elements significantly exceeds the number of channels handled by said optical device, said method comprising:

operating said optical device such that channel beams are incident on particular reflective elements, wherein at least one channel beam is incident on two or more reflective elements; and
manipulating said particular reflective members to optically couple at least a portion of said at least one channel beam to one or more ports.

31. A method of switching channels in an optical device having x, y, and z axes and comprising two or more ports along the y-axis, a wavelength discriminating device coupled to one or more of said ports, and an array of reflective elements, at least a portion of said reflective elements being optically coupled to said wavelength discriminating device to reflect said channel beams, at least two of said portion corresponding to a particular channel beam, said method comprising:

rotating at least two reflective elements of said portion about an axis parallel to said x-axis to switch the optical coupling of said particular channel beam from one port to another port along said y-axis.

32. A method of switching channels in an optical device having x, y, and z axes and comprising at least one port, a wavelength discriminating device coupled to said port, and an array of reflective elements, at least a portion of said reflective elements being optically coupled to said wavelength discriminating device to reflect said channel beams, at least two of said portion corresponding to a particular channel beam, said method comprising:

rotating selected reflective elements of said portion about said y-axis to produce a desired group delay profile.

33. The method of claim 32, further comprising:

rotating selected reflective elements of said portion about an axis parallel to said x axis to achieve a desired transmission profile.

34. The method of claim 32, wherein said optical device comprises two or more ports aligned along said y axis, and further comprising:

rotating selected reflective elements of said portion about an axis parallel to said x axis to achieve a desired transmission profile and/or switching function between said ports.